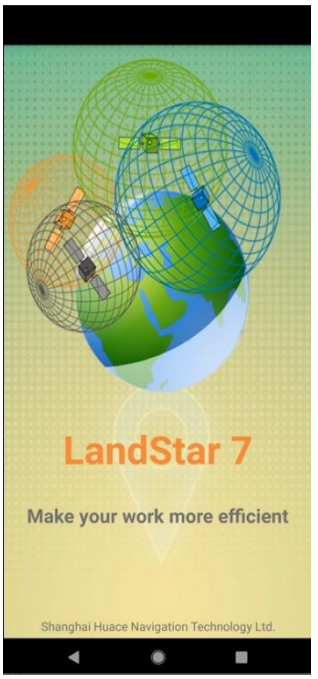
Getting Started Guide for iGage GNSS RTK Receivers used with:

X-PAD Ultimate



This manual is for use with iG GNSS Receivers sold by iGage Mapping Corporation.
Other receivers will have significantly different profiles.

8 March 2021

LS7_UserManual_R10.docx

LandStar7 Introduction

LandStar7 is a powerful Android field software solution that supports CHC and iG branded receivers sold by iGage.

This User Manual provides step-by-step instructions for:

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Purchasing LandStar7

LandStar7 has a single purchase price ($490 in 2021) which includes all functions and modules. A fully functional 60-day trial is available so that users can evaluate LandStar7's suitability for their purpose.

LandStar7 is licensed for use by a single user on a single device, however it is simple to move a LandStar7 license from one device to another device as the user obtains new Android devices.

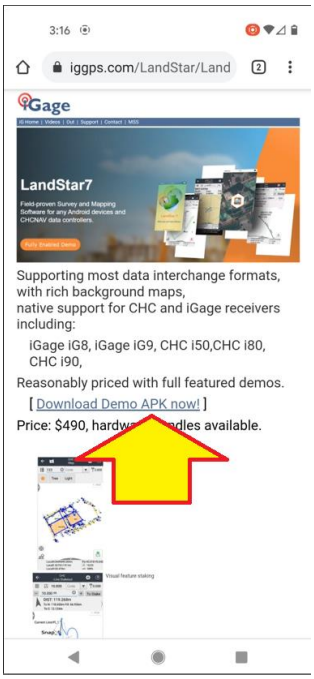
Installing LandStar7

An internet connection is required to activate LandStar7 so you must do the install and provisioning when WiFi or cellular data is available on the Android device.

The easiest way to install LandStar7 on an internet connected Android device is to browse to the website: www.iGGPS.com:

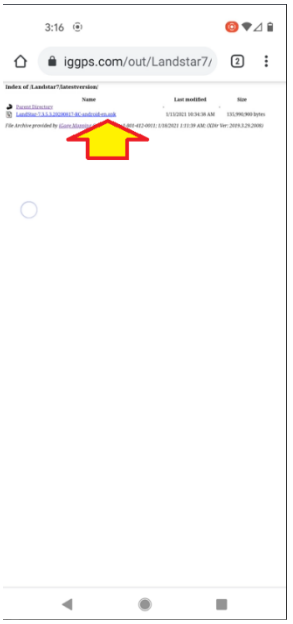
Find and click on the LandStar 7 link.

Find the **Download Demo APK now!** link and click on it:



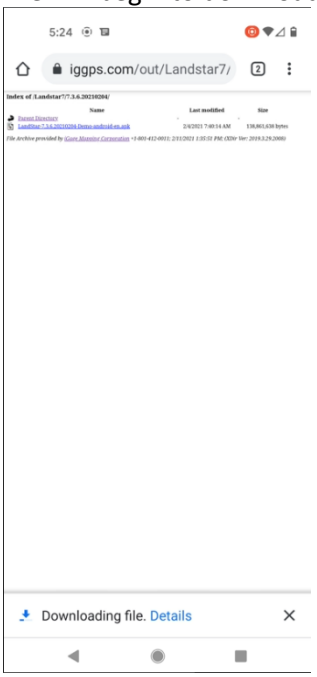
Wait a moment for your device to navigate to the link.

A web folder with the latest released version will be shown.

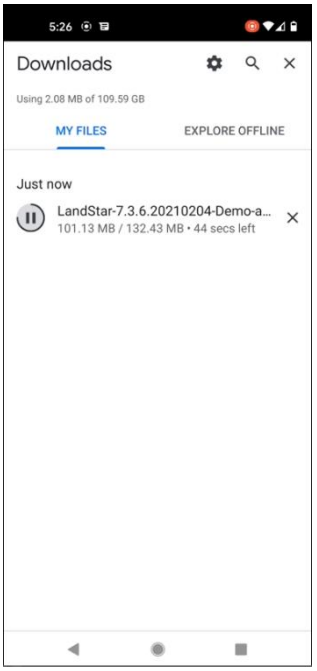


Click on the **.APK** installation file.

The file will begin to download:

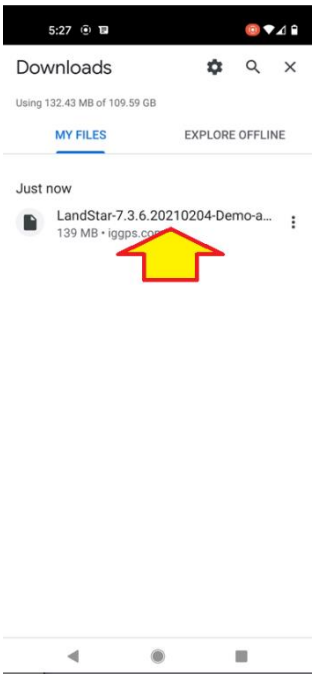


Click on **Details** to view the download progress.



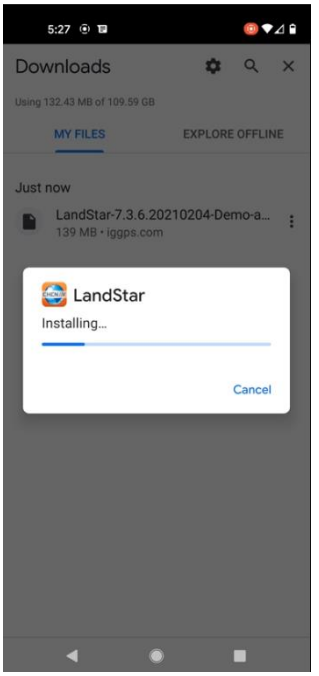
Wait for the file to download…

When the file has finished downloading:



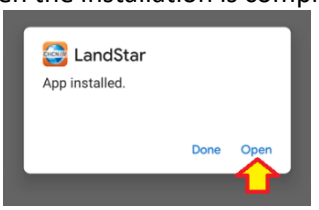
Click on the file. You may need to grant permissions to 'side-load' a program onto your device.

LandStar7 will install. (Note: if a previous version is already installed the new version will overwrite it. No data or settings will be lost.)



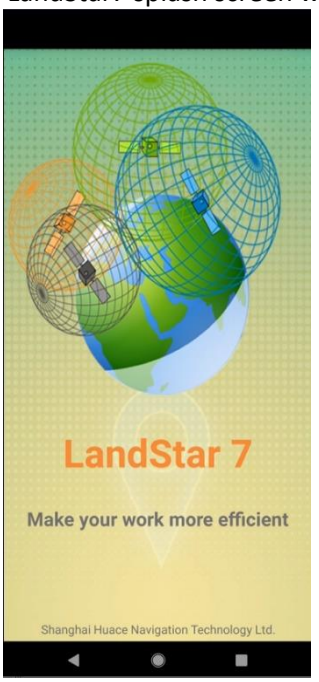
Wait for the installation to complete.

When the installation is complete:



Click on **Open** to launch LandStar7.

The LandStar7 splash screen will be shown:



The first time you run LandStar7 you will need to grant permissions to LandStar7 to continue:

Files and Media: LS7 needs to store jobs and access GEOIDS and coordinate systems.

Location: LS7 can use the internal GPS as a device, this is useful for demos and reconnaissance.

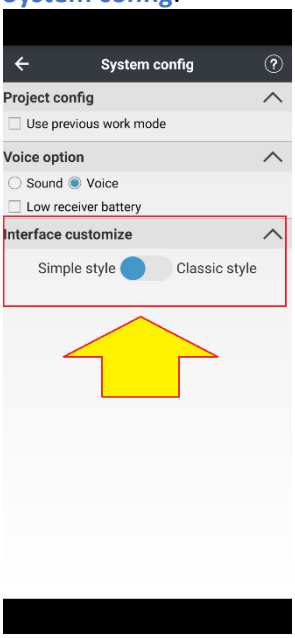
Phone: LS7 uses the IMEI number of your SIM card to bind your license to a device.

Camera: LS7 can take pictures and video then attach them to stored measurements.

After a few moments the main menu will be shown.

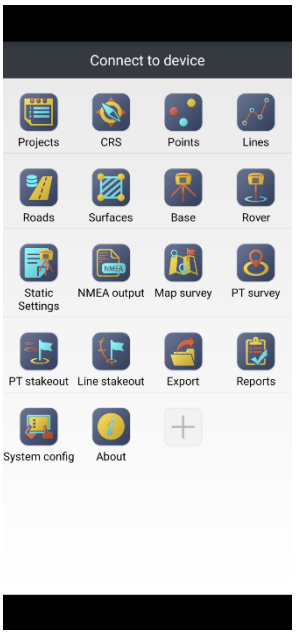
Classic or Simple main menu

LandStar7 has two menu types: **Simple** and **Classic** styles which are selected from **Config**: **System config**:



Interface Selection

Classic style



Simple style

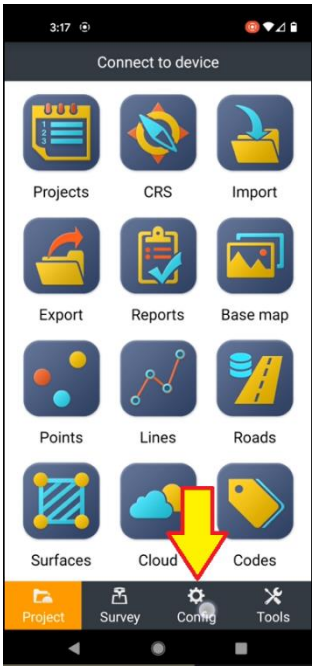
This entire guide is written assuming that you are in the default **Classic style** mode with all menus enabled.

It is recommended that you remain in the **Classic** mode, with all menus enabled, until you have mastered the functions that you need to be productive so that your menus will match those in this guide.

The **Simple style** allows you to configure which buttons are available and their display order to fully customize the LandStar7 interface. (Click and hold on existing icons to move or delete them, click on the **+** to add additional icons.)

Activating LandStar7

From the main menu:

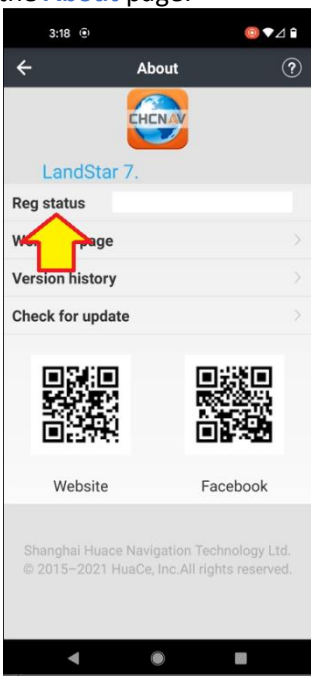


Click on **Config**.

From the Config menu:

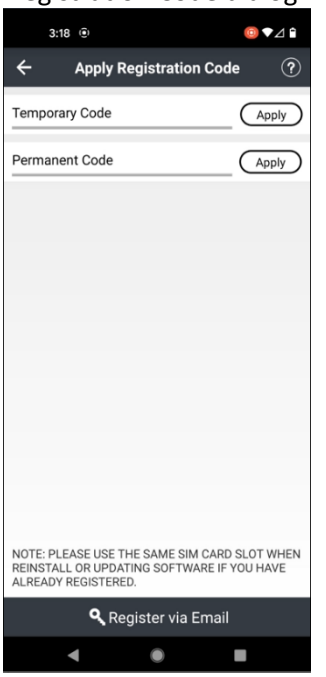
Click on **About**.

On the **About** page:



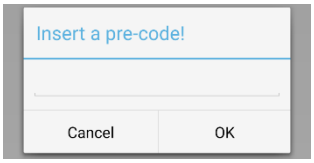
Click on **Reg status**.

The Registration Code dialog will be shown:



Permanent Code

If you have been supplied a 'PRE-CODE' (**Permanent Code**), click on the **Apply** button to the right of **Permanent** Code:

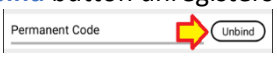


Then enter the pre-code and click on **OK**. Your license will be applied and bound to this Android device.

Transferring a license to a new device

LandStar7 is unique because you can easily 'unbind' a pre-code from a device and transfer the license to another device. No factory authorization or intervention is required if the device holding the code has internet access.

Once a device is registered the **Apply** button will change to an **Unbind** button. Clicking the **Unbind** button unregisters a device:

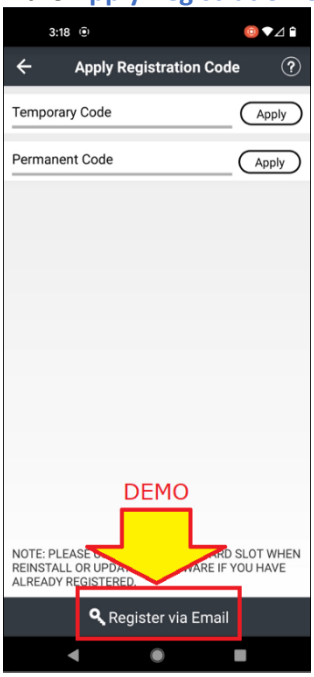


Which frees the license for installation. When you **Unbind** a license, the server will send a confirmation email to the registered email address that includes the **pre-code** assisting in alternate installation.

Getting a 90-day demo

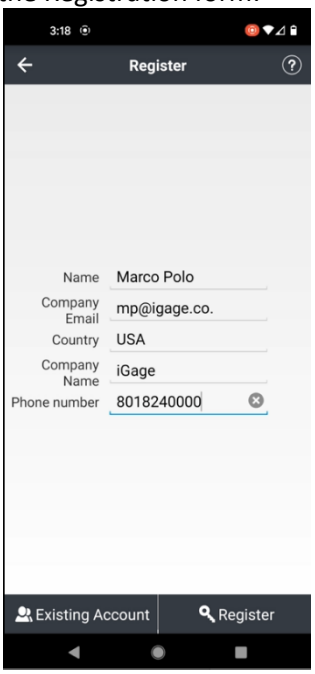
It is really simple to apply for a 90-day demo of LandStar7. Once you register online from LandStar7, you can immediately apply the demo license to the device.

From the **Apply Registration Code** screen:



Click on the Register via Email button at the bottom of the menu.

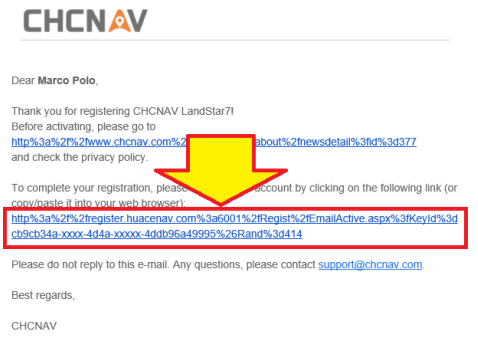
On the Registration form:



Enter your Name, email, Country and phone number.

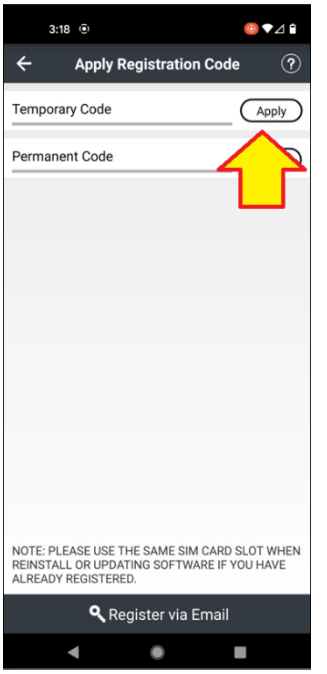
When you click on **Register**, an email will be sent to the address you entered. Task-switch to your email client, find the email from the

LandStar license server:



Click on the link in the email to activate a temporary (90-day) license.

Switch back to LandStar7:



Click on the **Temporary Code Apply** button. The program will automatically retrieve a demo license number and apply it to the device. The expiration date of your demo license will be displayed in the **Temporary Code** area of the registration screen.

Converting a demo to permanent license

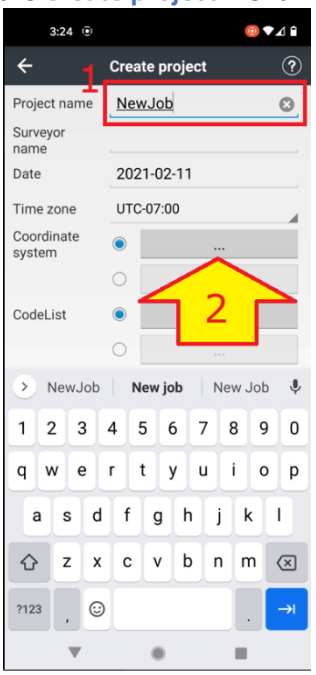
Since the demo program is the same as the fully licensed program, if you choose to purchase a permanent LandStar 7 license, all you need to do is apply the license and the demo will automatically convert to a permanent license.

Make a New Job

From the main menu:

Click on the **Project** tab, then **Projects**.

On the **Create project** menu:

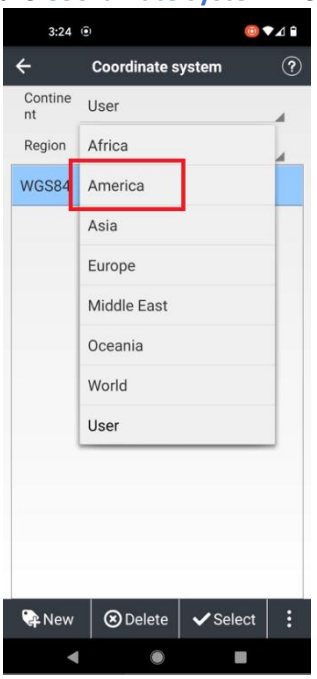


Enter a **Project name**, then click the **…** button by the **Coordinate system**.

There are thousands of predefined coordinate systems in LandStar7. You will want to add your local State Plane or LDP Zone to the 'short list' of common projections on the **Coordinate System** menu.

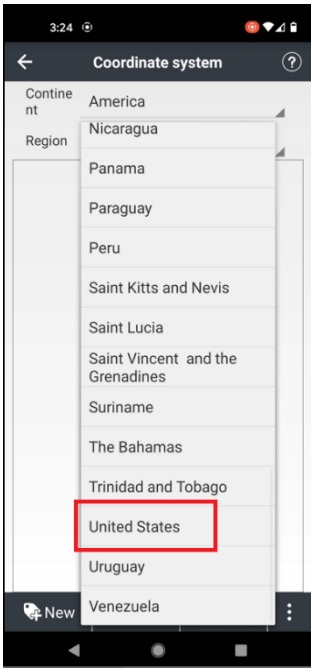
If existing jobs exist, you can use the second button to match the CRS information from any available job.

On the **Coordinate system** menu:



Set the **Continent** to **America**.

Then:



Set the **Region** to **United States**.

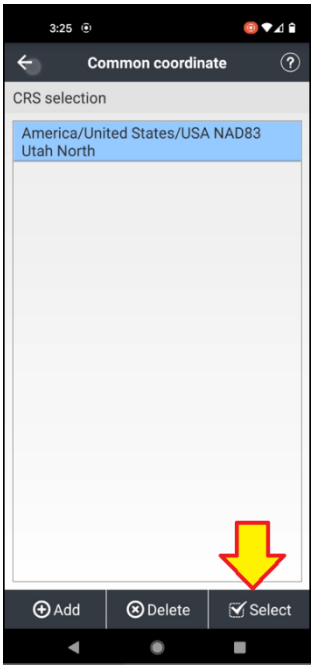
Finally:

The County projections for OCRS, Iowa and other specific states plus all of the UTM Zones covering the USA are at the bottom of this list.

Drag through the list and choose the State Plane Zone (1) for your survey area, then click on Select (2).

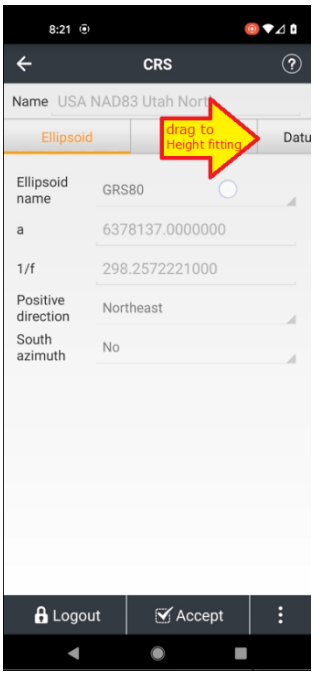
Click on the **Select** button at the bottom of the menu.

The **Common coordinate** list is shown with the new projection shown:



Click on the **Select** button at the bottom to apply this **CRS** (Coordinate Reference System) to the new job.

The new **CRS** will be shown:



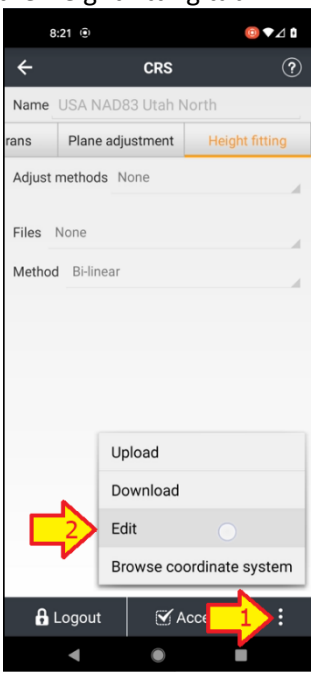
Drag this menu screen all the way to the right.

Adding a GEOID to a Coordinate system

The GEOID compensates for differences in gravity and allows LandStar7 to convert GPS derived ellipsoid heights to orthometric heights. In the USA a new 'National GEOID' is released for the continental states every five years. A single .BIN file can be downloaded

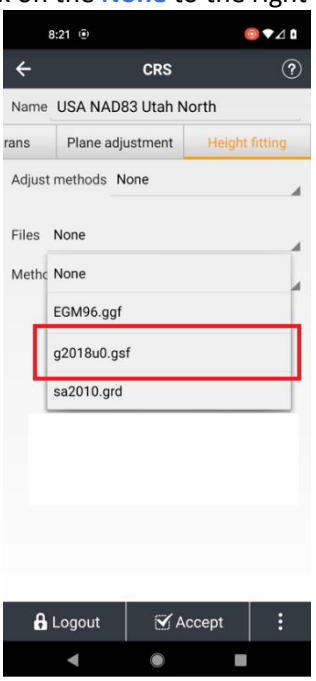
from the NGS website which contains the latest version and may be contained in the LandStar7 program distribution.

On the Height fitting tab:

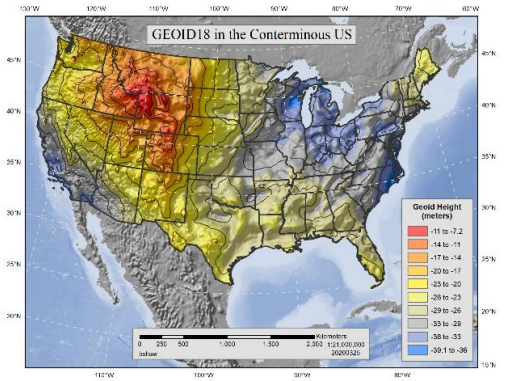


Click on the **…** button on the bottom right corner, then click on **Edit**. This will allow selection of a GEOID to use with the CRS.

Click on the **None** to the right of **Files**:



If you are in the Continental USA, select the g2018u0.gsf (this is currently the latest GEOID for the USA and covers this area:



*If you are in another region of the USA, download the appropriate .BIN file from the NGS GEOIDS download page (**use the le – Little Endian file**) and put it in the GEOID folder on the Android device which will be in a path similar to this:*

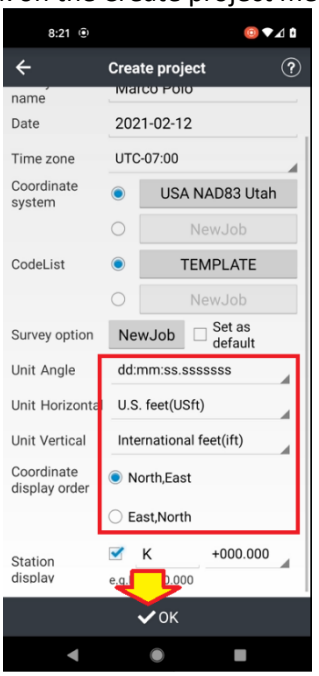
/sdcard/CHCNAV/LandStar7/Geoid

After you restart LandStar7 the GEOID will be available in the list.

Finally, click **Accept** to save and use the GEOID.

Selecting Job Units and Settings

Back on the Create project menu:



you will want to choose appropriate **Horizontal**, **Vertical** units and choose **North/East** as the **Coordinate display order**.

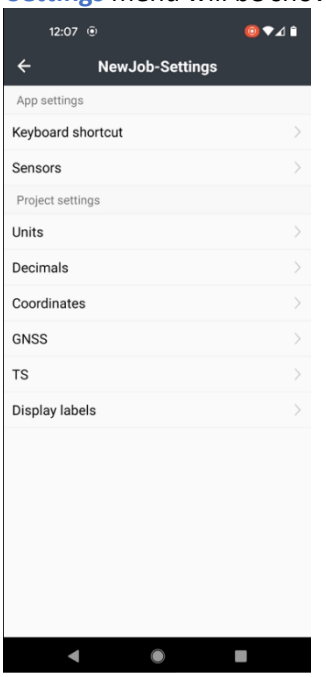
Finally click on the **OK** button to save the new job.

Additional System Settings

There are a few system wide settings to look at before you begin your first job. From the main menu, click on **Config**:

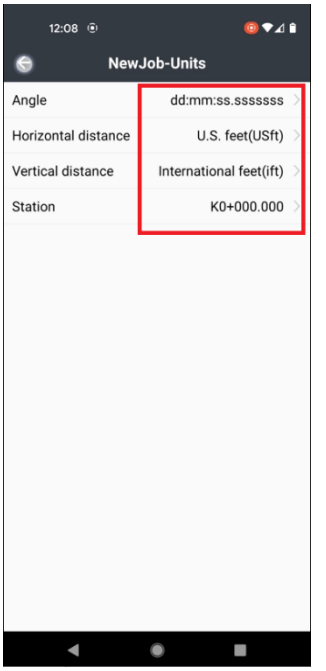
then **Settings**.

The **Settings** menu will be shown:



Settings: Units

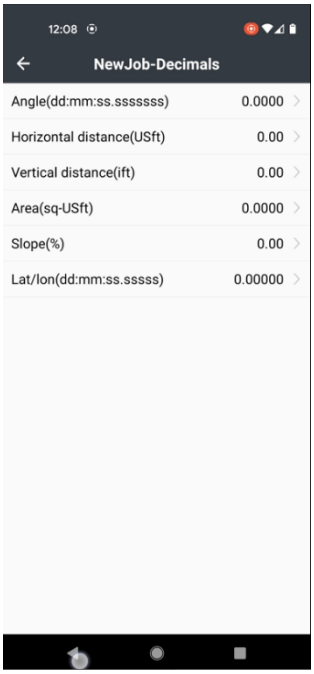
Click on Units:



Note: It is common to have **US Survey Feet** for **Horizontal distance** and **International Feet** for **Vertical distance** as shown.

Settings: Decimals

Click on **Decimals**:

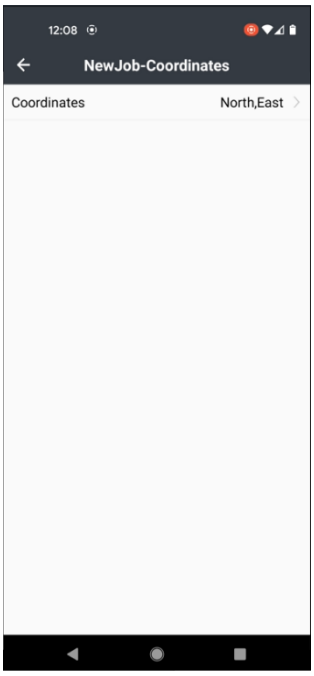


To set the displayed decimals for **Horizontal**, **Vertical**, **Slope** and **Lat/Lon** units.

The settings shown above are appropriate for most GNSS applications in feet.

Settings: Coordinates

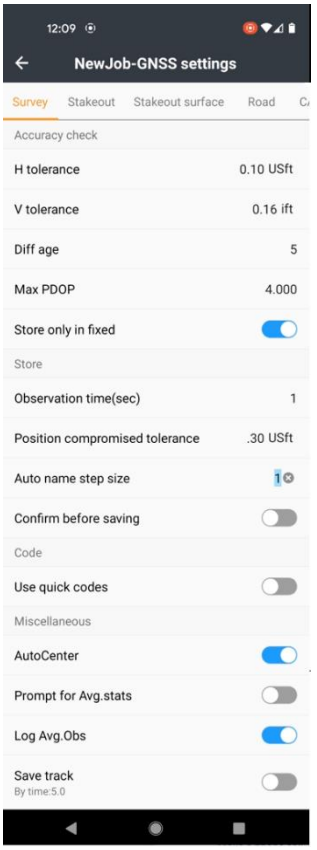
Click on **Coordinates**:



To select between **Northing, Easting** and **Easting, Northing** coordinate order.

Surveyors and engineers in the USA typically select **Northing, Easting**.

Settings: GNSS



Horizontal tolerance

If the estimated **Horizontal error** exceeds the **Horizontal Tolerance** (**H tolerance**) it will be necessary to manually override a warning to store a shot.

Horizontal error is the receiver's estimate of the horizontal accuracy based on the goodness-of-fit for multiple satellite signals. It includes measured signal-to-noise values along with PDO estimates.

Error estimates are 1-Sigma (68%) confidence values.

Vertical tolerance

If the estimated **Vertical error** exceeds the **Vertical tolerance** (**V tolerance**) it will be necessary to manually override a warning to store a shot.

Horizontal error is the receiver's estimate of the horizontal accuracy based on the goodness-of-fit for multiple satellite signals.

It includes measured signal-to-noise values along with PDO estimates.

Error estimates are 1-Sigma (68%) confidence values.

Diff age

If the **Diff age** (**Differential age** or **Latency**) is higher than the entered tolerance, it will be necessary to manually override a warning to store a measurement.

Diff age is the time since the last complete valid correction was received from the base. **Diff age** can be high if a radio signal is noisy or if there is significant packet loss on a network rover.

Max PDOP

Max PDOP tolerance sets the maximum allowable PDOP to all shots to be recorded without manual override.

Most of the time with GNSS receivers and common constellations, PDOP is around 2.5 or lower.

PDOP is a mathematical function of error propagation as a result of navigation satellite geometry on positional measurement precision. PDOP is not dependent on the quality of received signals, only the number and position of satellites in the sky.

Store only in fixed

Store only in fixed prevents FLOAT, DGPS and AUTONOMOUS measurements from being stored without a manual override.

If you are doing reconnaissance with WAAS corrections, you will want to disable this check to allow DGPS measurements to be stored.

Observation time

Observation time (sec) is the averaging time to collect data for a measurement.

Position compromised tolerance

If the Observation time is set to 2 or higher then a warning will be issued if the range of individual measurements exceeds this tolerance.

If you are hand-holding the rod a reasonable setting might be 0.3'. If you have the rod secured in a bipod then a tighter tolerance like 0.05' might be more appropriate.

Auto name increment

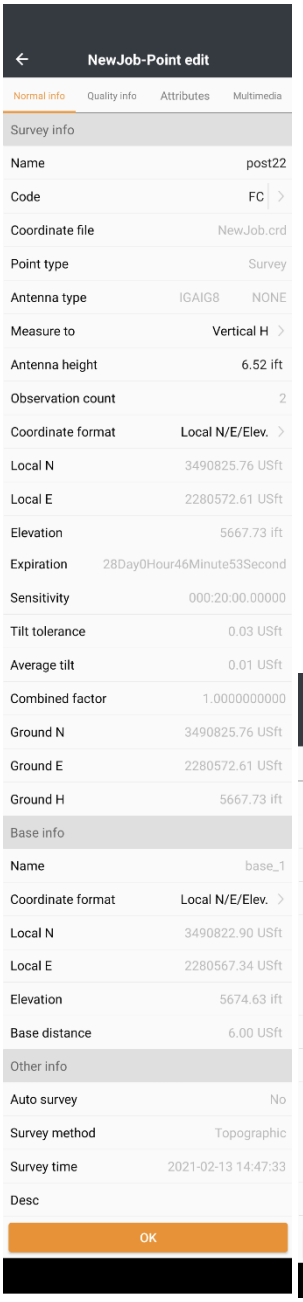
Auto name step size sets the interval of increment for the **Point Name**. It is typically set to '1'. Set to '0' (zero) to disable auto incrementing.

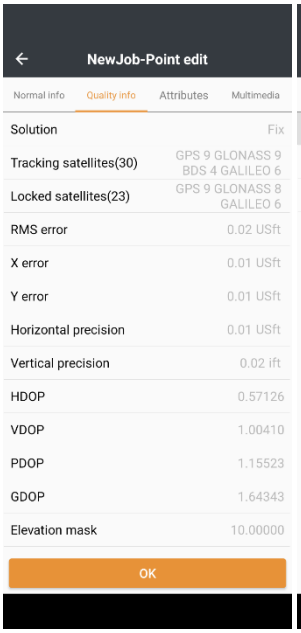
Confirm before saving

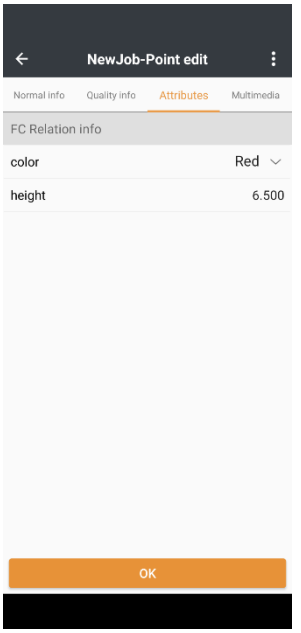
Turning **Confirm before saving** ON will confirm each measurement prior to storage.

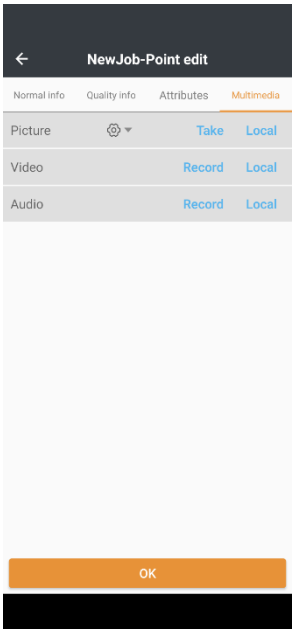
If you want to add extended attributes like: descriptions, feature attributes, pictures to stored points; you need to enable this option.

With confirmation enabled, the following dialog set is shown after each point is stored:


NewJob-Point edit
Normal info
Quality info
Attributes
Multimedia
Survey info
Name post22
Code FC
Coordinate file NewJob.crd
Point type Survey
Antenna type IGAIG8 NONE
Measure to Vertical H
Antenna height 6.52 ift
Observation count 2
Coordinate format Local N/E/Elev.
Local N 3490825.76 USft
Local E 2280572.61 USft
Elevation 5667.73 ift
Expiration 28Day0Hour46Minute53Second
Sensitivity 000:20:00.00000
Tilt tolerance 0.03 USft
Average tilt 0.01 USft
Combined factor 1.0000000000
Ground N 3490825.76 USft
Ground E 2280572.61 USft
Ground H 5667.73 ift
Base info
Name base_1
Coordinate format Local N/E/Elev.
Local N 3490822.90 USft
Local E 2280567.34 USft
Elevation 5674.63 ift
Base distance 6.00 USft
Other info
Auto survey No
Survey method Topographic
Survey time 2021-02-13 14:47:33
Desc
OK


NewJob-Point edit
Normal info
Quality info
Attributes
Multimedia
Solution Fix
Tracking satellites(30) GPS 9 GLONASS 9 BDS 4 GALILEO 6
Locked satellites(23) GPS 9 GLONASS 8 GALILEO 6
RMS error 0.02 USft
X error 0.01 USft
Y error 0.01 USft
Horizontal precision 0.01 USft
Vertical precision 0.02 ift
HDOP 0.57126
VDOP 1.00410
PDOP 1.15523
GDOP 1.64343
Elevation mask 10.00000
OK


NewJob-Point edit
Normal info
Quality info
Attributes
Multimedia
FC Relation info
color Red
height 6.500
OK



It is possible to edit the Instrument Height of the receiver using **Measure to** and **Antenna height** after a measurement has been stored.

Using the **Coordinate format** items it is possible to change the displayed coordinate style:

Local N.E.Elev
WGS84 lat/lon/H
Local lat/lon/H

The **Quality info** tab displays the measurement attributes reported by the GNSS receiver for the point and include the best and worst differential correction age plus the tracked constellations.

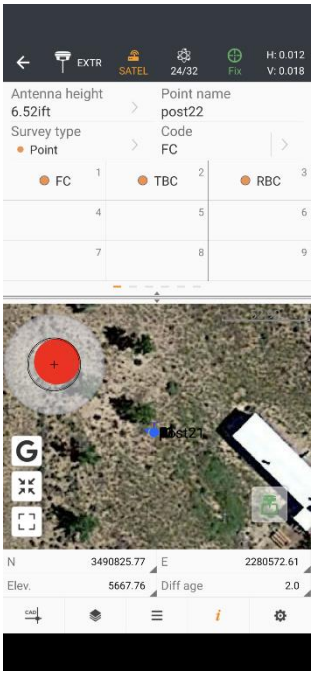
The **Attributes** tab allows user entry of any measurement attributes assigned to the **FC** (Field Code).

The **Multimedia** tab allows Pictures, Videos and Audio to be associated with the measurement.

Use quick codes

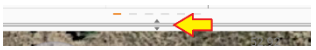
Use quick codes adds Quick Code buttons to the survey screen to allow quick selection of QC codes when collecting measurements:

Use quick codes = **OFF**



Use quick codes = **ON**

The size bar:



allows the quick code button area to be resized for larger or smaller buttons.

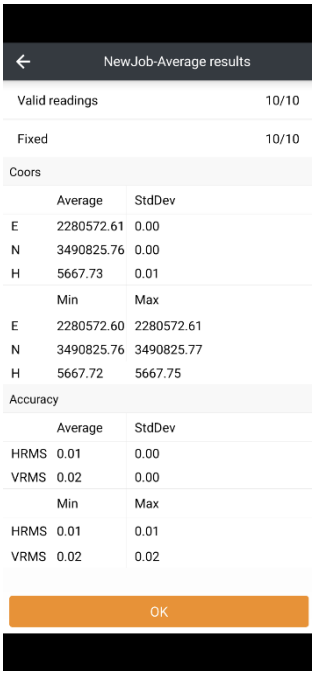
There are 6 pages of quick code buttons which can be scrolled left and right.

AutoCenter

Enabling **AutoCenter** will keep the receiver's position centered on the map automatically.

Prompt for Avg stats

If **Prompt for Avg stats** is enabled, then after a measurement with more than 1-epoch the **Average results** screen:



Will be shown so you can evaluate the averaged measurement prior to storing.

If **Confirm before saving** is also enabled, then then the confirmation screen will be displayed after the **Average results**.

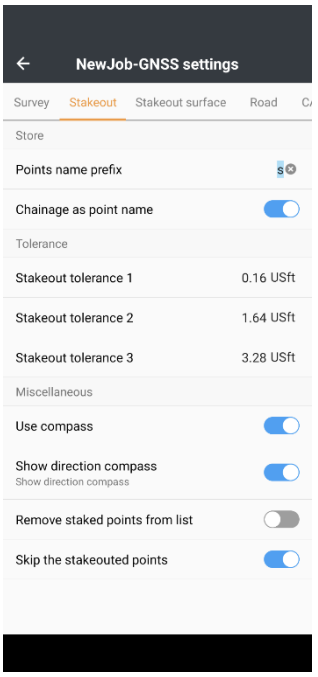
Save track

Also called 'Auto-by-Interval'.

Enabling **Save track** will prompt for **Time** or **Distance** and then the Time/Distance interval.

When enabled, points will automatically be stored using the current **Code** and incrementing **Point names** until disabled.

Settings: Stakeout



Points name prefix sets the string that is pre-pended to point names for staked points.

Chainage as point name also adds the alignment distance (station) to the point name when staking a line.

Stakeout tolerance 1 through **3** sets the tolerance for the audible tone which changes tone as you get nearer to the staked point.

Use compass uses the compass in your Android device to additionally prompt the direction to move to reach the selected point to stake.

If **Use compass** is enabled then **Show direction compass** enables the onscreen compass:

If you have defined a list of points to stake then **Remove staked points from list** removes each point from the list as it staked.

Skip the stakeouted points will skip points in the defined staking list if they have already been staked out.

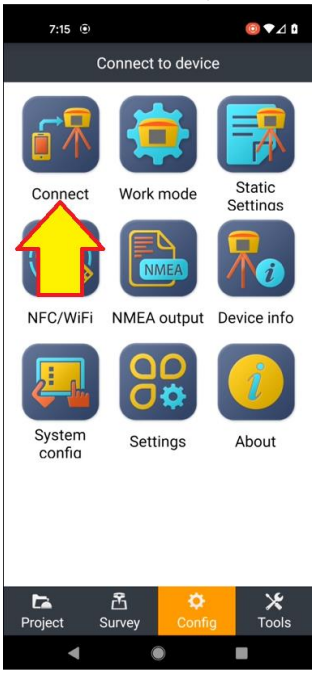
Using LandStar7 with a GNSS Receiver

There are three main steps to using a GNSS receiver with LandStar7:

1. Connecting to the receiver by Bluetooth
2. Configuring a Work mode profile
3. Activating the Work mode

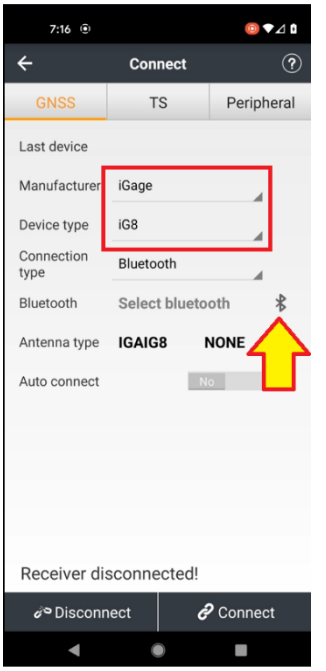
Setting up a Bluetooth connection

From the main menu, click on **Config**:



Then click on **Connect**.

On the **Connect** menu:

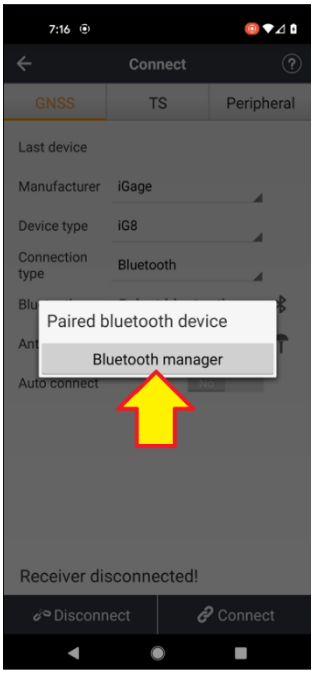


Set the **Manufacturer** to **iGage**.

Set the **Device** type to **iG8** or **iG9** (depending on your model).

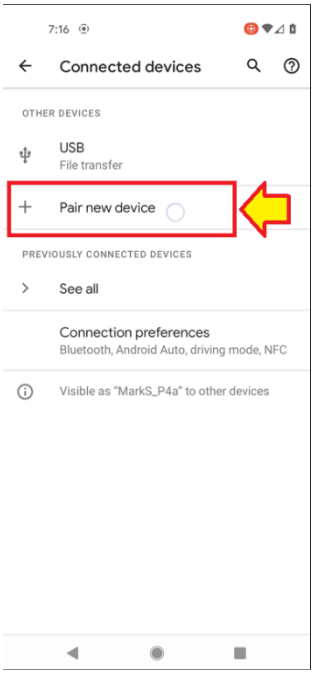
Finally click the **Bluetooth** symbol .

The **Paired Bluetooth device** list is shown:



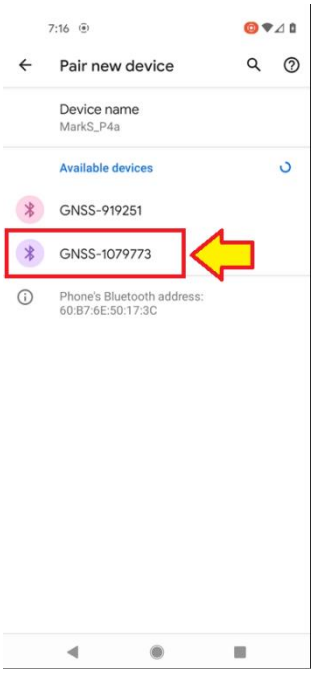
If the device you want to configure is shown, click on it. Otherwise, click on **Bluetooth manager** to bring up the device's **Bluetooth manager**.

On the device's **Bluetooth manager** or **Connected devices** menu:



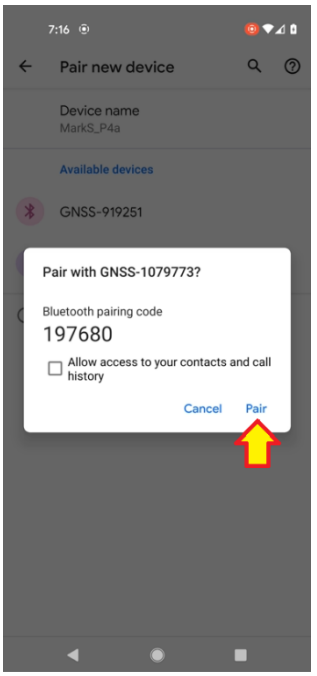
Click on **Pair new device**.

Wait a moment, then when the correct receiver is listed as available:



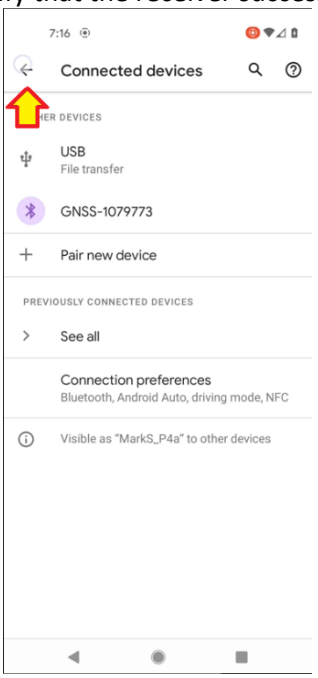
Click on it.

Your Android device will verify that you want to pair with the receiver:



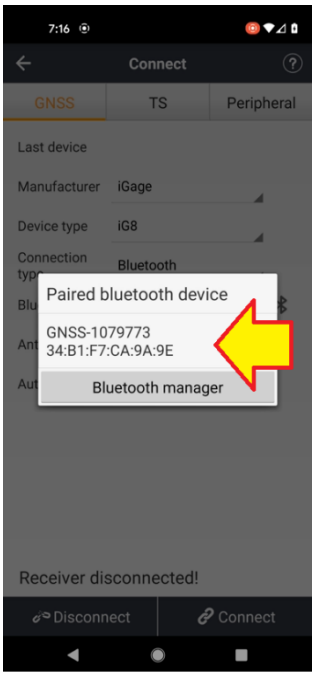
Click on **Pair**.

Verify that the receiver successfully paired:



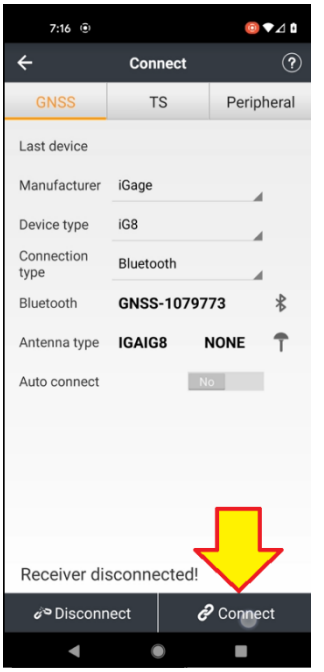
Then click on the **back arrow** to return to LandStar7.

The **Paired Bluetooth device** list will now include the receiver:



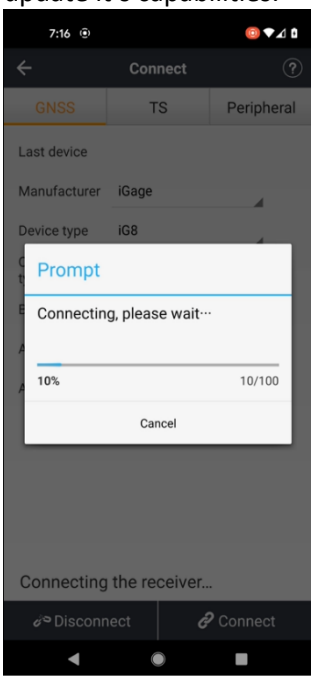
Click on the receiver.

On the Connect menu:

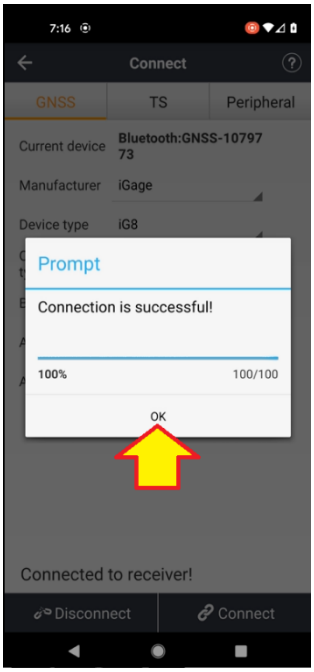


Click on **Connect**.

LandStar7 will connect to the receiver and update it's capabilities:

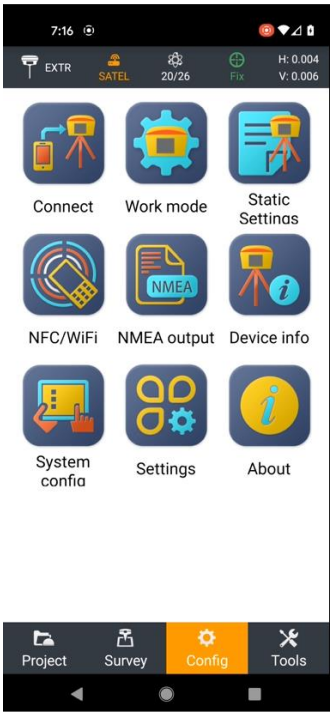


After a few seconds, the connection will be valid:



Click on **OK** to acknowledge the successful connection.

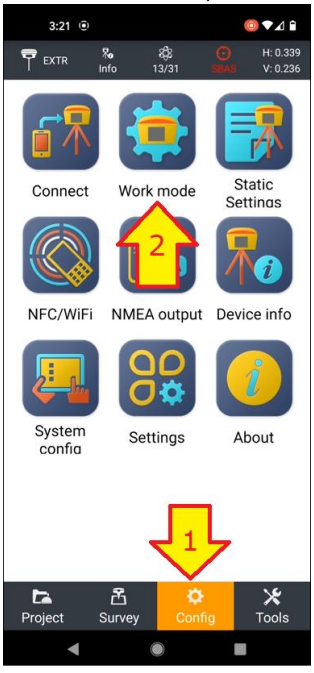
LandStar7 will return to the main menu:



Configuring a Network Rover profile

A network rover uses correction messages from a base or virtual base, accessible via the internet to obtain an accurate fixed solution. LandStar7 uses the network connection of the Android device, either a cellular data connection or a Wi-Fi connection to an external hotspot.

From the main menu, click on Config (**1**):

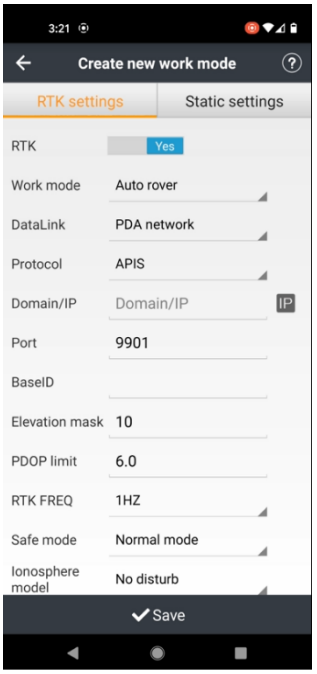


then click on **Work mode**.

On the **Work mode** list:

Click on the **New** button to define a new connection.

On the **Create new work mode** dialog:



Leave **RTK** set to **Yes**.

Set the **Work mode** to **Auto rover**.

Network Rovers can get corrections via the internet connection on the Android data collector which is called DCI (Data Collector Internet or PDA) or by using a SIM card in the GNSS receiver. If LandStar7 is installed on a phone then DCI / PDA is most likely the preferred **DataLink mode**.

If you are using the network / data connection on your Android device set the **DataLink** to **PDA network**, if you are using a SIM card installed in the Rover receiver set the **DataLink** to **Receiver network**.

There are two common network protocols:

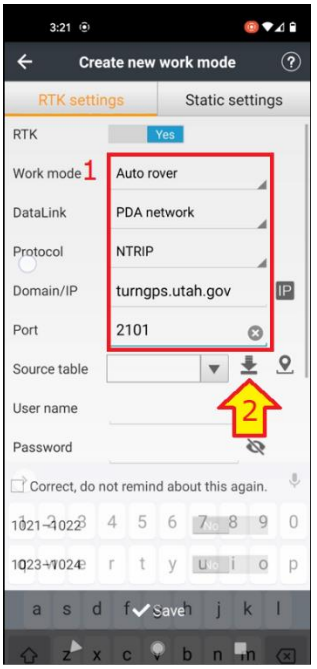
NTRIP used for subscription networks

TCIP/DIP/Point-to-Point Direct Internet Protocol used for some public networks

To make a network connection you will need to know the **IP Address** and **Port**; for NTRIP you will also need a valid **User Name** and **Password**.

Proceed to the **NTRIP** or **DIP/TCP Direct** sections below depending on your server type.

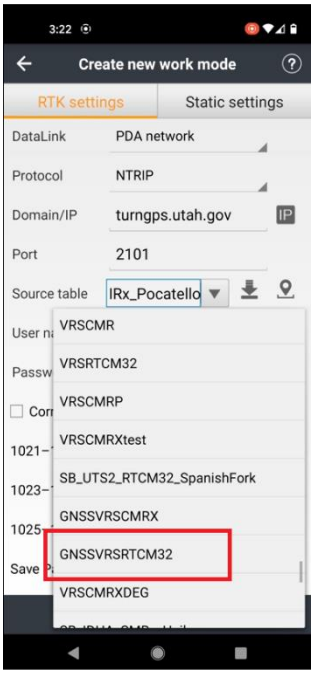
NTRIP



Choose **Protocol** = **NTRIP** if your server requires a **User Name** and **Password** then enter the **Domain** name or dotted **IP** address, **Port**, **User name** and **Password**. Double-check all of these values, Name and Password are case sensitive and all require exact entry.

Click on the download Source table button (2).

If the IP address and Port are correct, after a few seconds the **Source table** entry will populate with the server's full mount table:



Choose the best mount point from the **Source table**:

Typically, RTCM3.2 - MSM - VRS mount points will be the best

Otherwise in order of preference:

SCMRx, RTCM3.2 MSM, RTCM3.2, RTCM3.1, RTCM3.x, RTCM3

Do NOT choose **CMRx** (SCMRx and **CMRx** are not the same and are purposely incompatible.)

The following types of mount points are less-desirable and will have corrections for GPS and GLONASS without L2C, L5 and GLO L3 support:

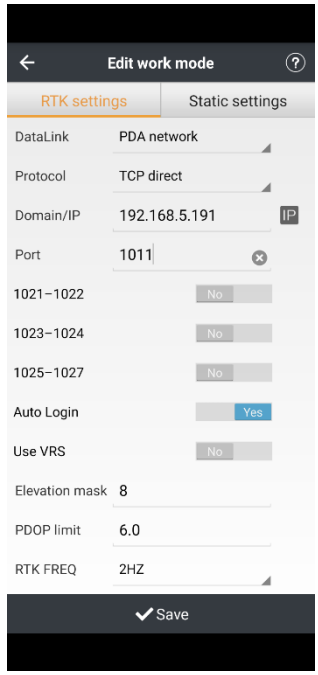
CMR+, RTCM2, CMR, RTCM

In some situations, like when you are on the edge of the network, a 'nearest station' mount point might be best.

Continue setup below at **1021…**

DIP / TCP direct

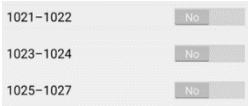
Choose **Protocol** = **TCP direct** if your server is public and uses Direct Internet Protocol / TCPIP / Telnet (there will be no **User name** or **Password** for DIP servers):



Enter the **Domain/IP** and **Port**.

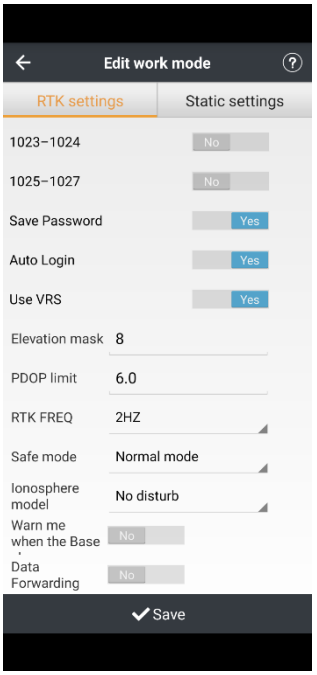
1021…?

The following three message types:



Should almost **always be set to No**.

These RTCM3 message types can define a local projection and localization for a construction site. If you need to enable them, you will surely know it. If you are not absolutely positive that they are correctly defined for your server set them to **No**!



Save Password will save the password so you do not need to re-enter it each time you connect to the server. Set to **Yes**.

Auto Login will automatically reconnect if communication with the server is interrupted. Set to **Yes**.

For VRS or Multi-Station NTRIP server mount points, **Use VRS** should be set to **Yes**. If set to **Yes**, a NMEA GGA string (your rover position) will be sent continuously to the server. If you are connecting to a SBL (Single Base Line) mount point you can set **Use VRS** to **No**.

For DIP/TCPIP servers, **Use VRS** will usually be set to **No**. If set to **Yes**, a NMEA GGA message (your rover position) will continuously be sent to the server.

Elevation mask is the angle above the horizon that satellites will be ignored. Typical settings will be 8 to 15-degrees. If you are working in a high canopy environment then setting as high as 25-degrees might be reasonable. A default value of **8** or 10 is reasonable.

If the PDOP is higher than the **PDOP limit**, the receiver will not indicate a FIXED position. 6 is a typical value. There is a separate PDOP tolerance in the **Survey setup** menu which will allow the receiver to FIX, but throw a tolerance violation which can be overridden.

RTK Frequency controls the Kalman filters applied to the RTK position. 1 or 2 Hz is typical.

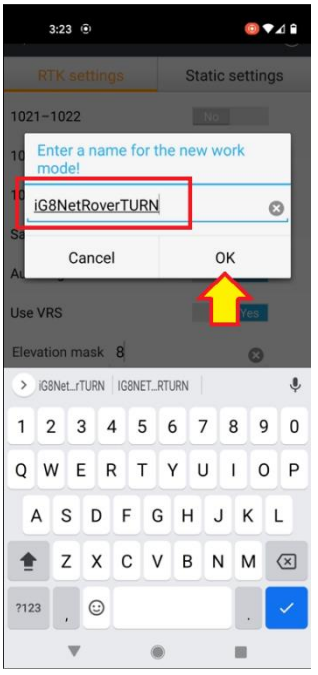
On some receivers the **Safe mode** will enable a 'Verified FIX' RTK mode on the receiver. Many receivers do not implement non-verified FIXs and this setting has no effect.

Ionosphere model is typically set to No disturb.

Data Forwarding allows you to share network corrections with other rovers on a jobsite using the internal UHF radio. Only one receiver needs to connect to the network server, the stream is then rebroadcast and can be used by nearby receivers.

After double-checking the settings, click on **Save.**

You will be prompted to enter a profile name for the new work mode:



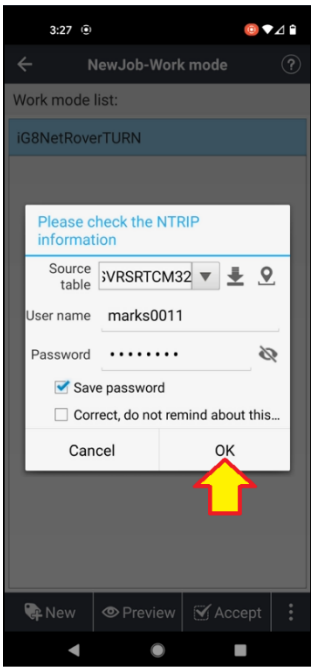
Enter a unique profile name and then click on **OK**.

Starting a Work Mode

After entering the Network Rover profile, from the **Work mode** menu:

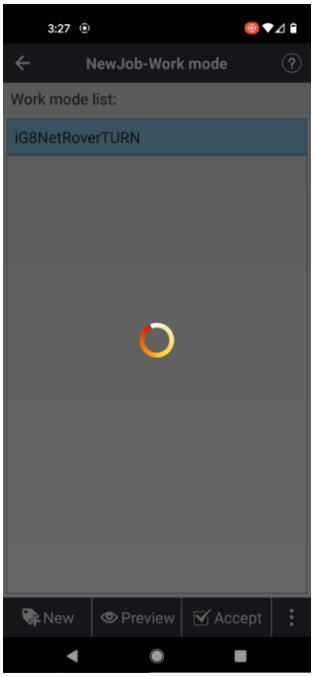
Click on the desired **Work mode**, then click on **Accept**.

The GNSS receiver will be initialized and LandStar7 will confirm the mount point **Source table** and credentials for the server:



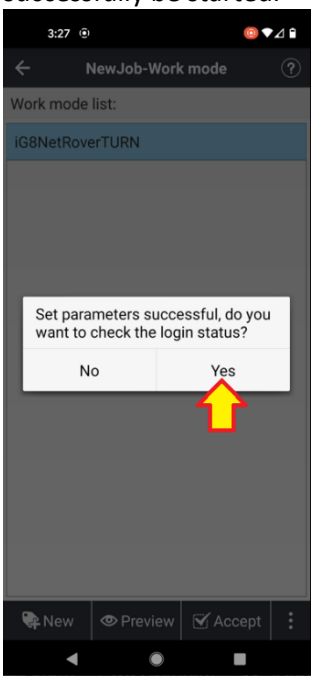
If all the values are correct and you don't want to see this confirmation again, check the **Correct, do not remind** checkbox.

Click **OK**.



Wait while the network server is contacted and corrections are started.

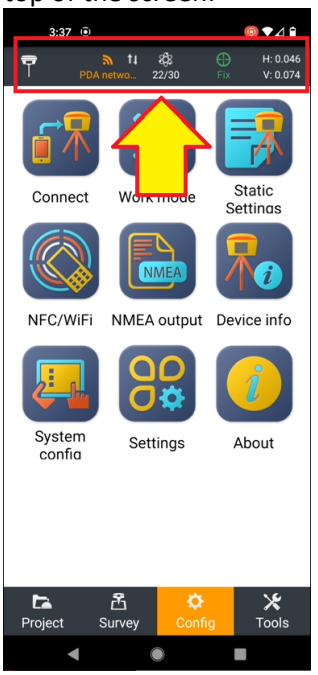
After a few seconds, corrections should successfully be started.



Click on Yes to inspect details about the correction source.

After verifying a successful connection, use the back arrow to return to the main menu.

The receiver status should be shown at the top of the screen:

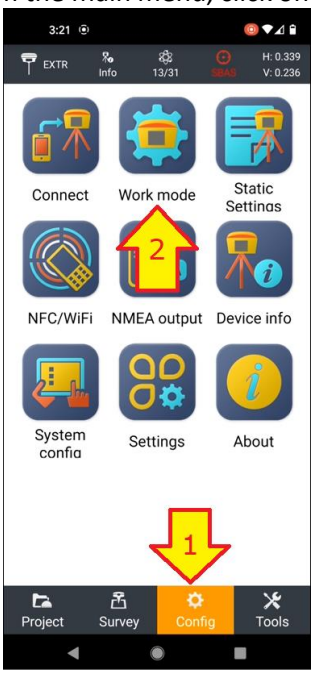


If the receiver has a clear view of the sky and the network connection is valid the status will change to Fix with low Horizontal and Vertical Standard Deviations and you will be ready to survey.

Configuring a UHF Base

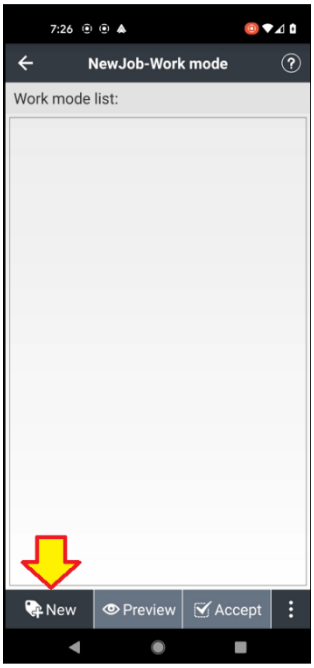
First follow the instructions in the **Setting up a Bluetooth connection** section on page 20 to pair your base to the Android data collector.

From the main menu, click on Config (1):



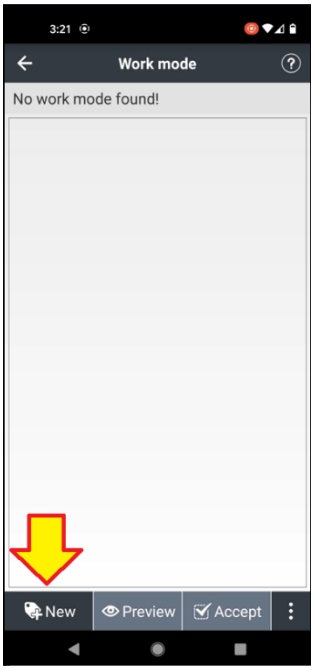
then click on **Work mode** (2).

The Work mode list will be shown:



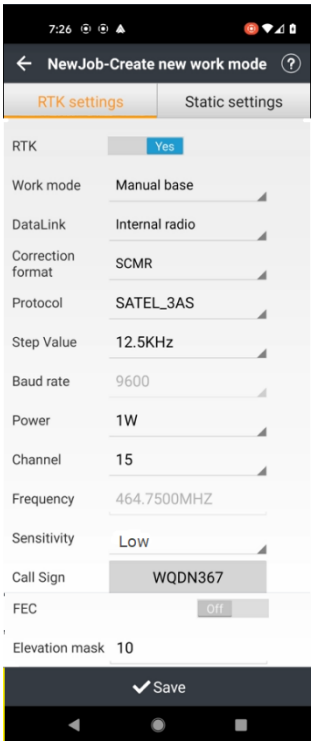
Click on the +New button to define a new profile.

On the **Work mode** list:



Click on the **New** button to define a new connection.

On the **Create new work mode** dialog:



Set the **RTK mode** to **Yes**.

Set the **Work mode** to **Manual base**.

Set the **DataLink** to **Internal radio**.

Set the Correction format to **SCMR** (sCMRx) or **RTCM3.2**.

Set the protocol to **SATEL_3AS**, with a **Step Value** (Channel Bandwidth) of **12.5 KHz**.

Set the **Power** to **1-watt**.

Choose a radio frequency that is not is use.

Set the **Sensitivity** to **Low**. (Set Sensitivity Low on the Base and High on the Rover.)

Verify that your **FCC Call** sign is correct.

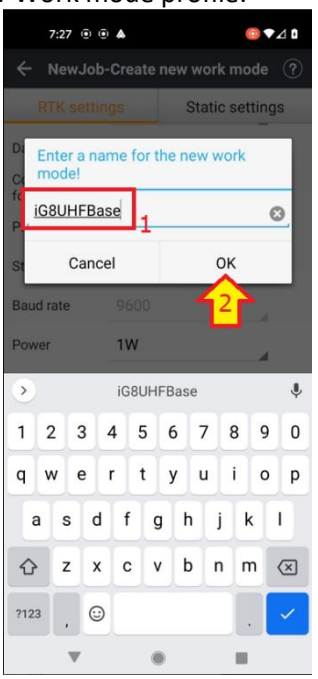
Set **FEC** to **On** for best range.

Set the **Elevation mask** to a low value, **5** to **10** degrees.

Make a note of the radio settings so you can match them on the rover.

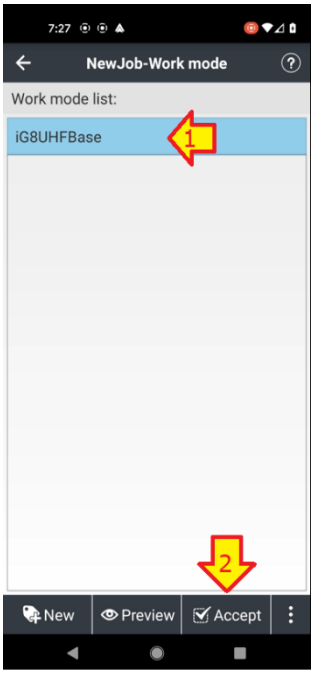
Finally click on **Save**.

LandStar7 will prompt for a name for the new Work mode profile:



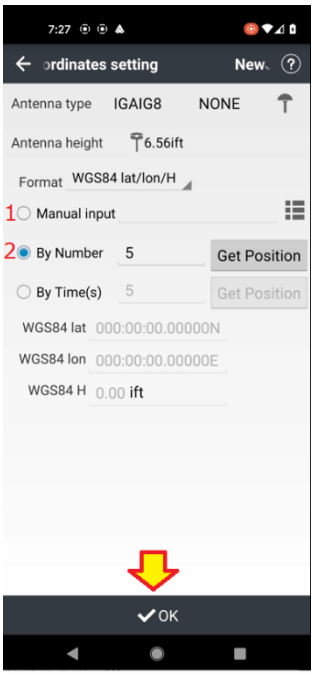
Enter a suitable profile name (**1**) then click on **OK**.

From the Work mode list:



Click on the new profile (1), then click on Accept (2).

The Base coordinates setting menu will be shown:



Enter the coordinate of the Ground Mark which is the **Antenna Height** below the bottom of the receiver.

You can enter a known position using the **Manual input** option (1), then picking a position from the job using the select button or hand entering a coordinate. Use the

Format drop down to enter the position as a Lat/Lon/Ellipsoid-Height or with Local N/E/Orthometric-Elevation.

You can also read the GPS (2) using an average collected by **Time** or **Number** of epochs.

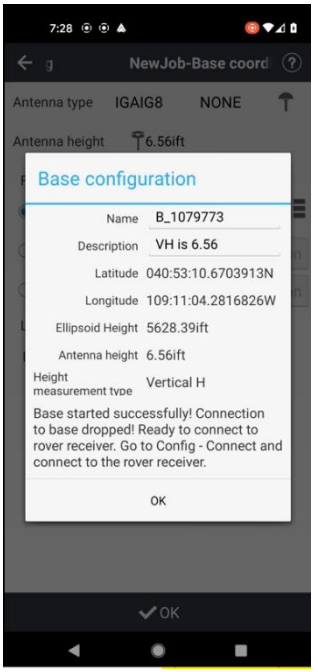
After you verify the position click on the **OK** button to start the Base.

Important Note: The position that you program into the base needs to be within 10-meters of the true WGS84 position of the Base. It is estimated that every 10 meters of base position error translates into 1 part-per-million error at the Rover. If the programmed base position is in error by more than 100 meters, the Rover will have a very difficult time computing a FIXED position.

If you use By Time or By Number and read the GPS, the position will be within 3-meters E, N, H of the actual location.

If you use a known position, then it is worth a few moments to first do a By Number average, write down the actual position and then recall the known position from the job and make sure it is reasonably close.

Once the base has been started, LandStar7 will show a confirmation message and drop the connection to the Base:



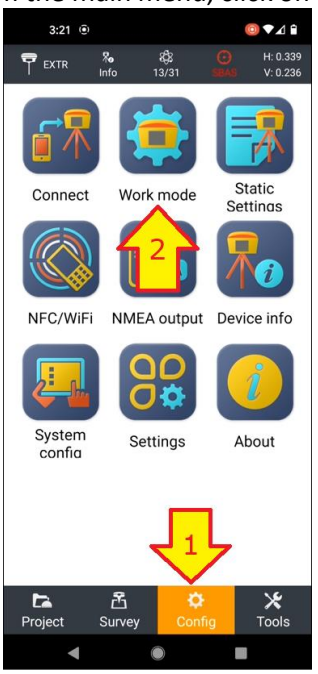
Click on **OK** to continue.

You are now ready to configure a Rover.

Configuring a UHF Rover

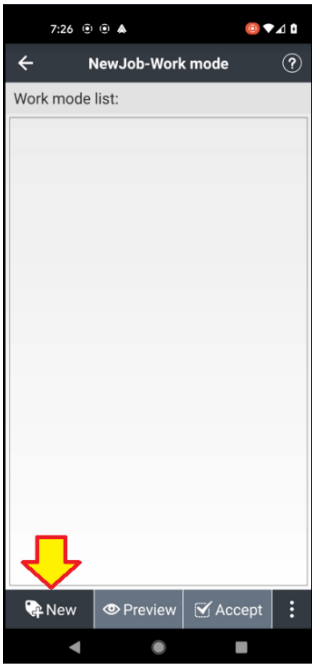
First follow the instructions in the **Setting up a Bluetooth connection** section on page 20 to pair your rover to the Android data collector.

From the main menu, click on Config (1):



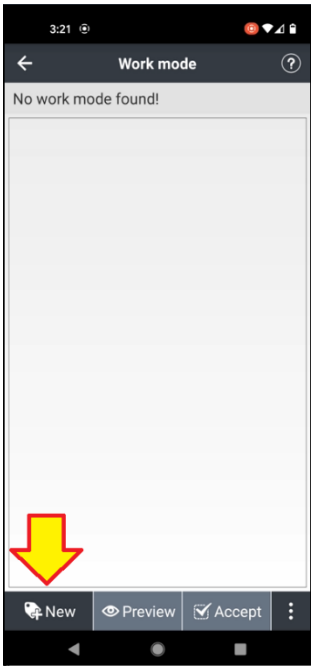
then click on **Work mode** (2).

The Work mode list will be shown:

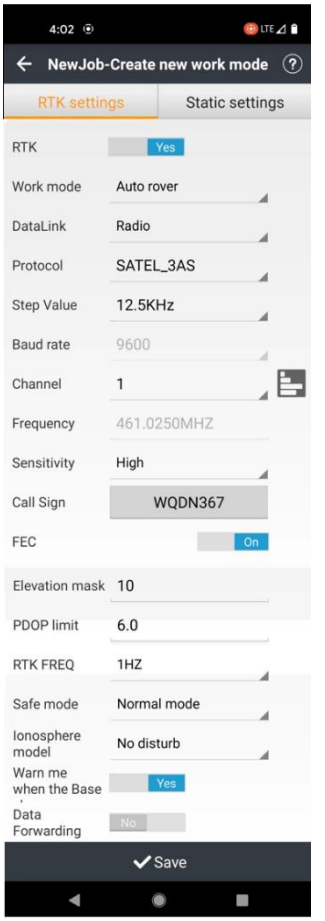


Click on the +New button to define a new profile.

On the **Work mode** list:



Click on the **New** button to define a new connection.



Set **RTK** to **Yes**.

Set the **Work mode** to **Auto rover**.

Set the **DataLink** to **Radio**.

Set the **Protocol** to **SATEL_3AS**.

Set the **Step Value** to **12.5KHz**, this will fix the **Baud** rate at **9600**.

Choose the **Channel** so that the **Frequency** exactly matches the **Frequency** on the Base.

Set the **Sensitivity** to **High**. The Rover should always have High Sensitivity to maximize the available working distance.

Verify your **Call Sign**.

FEC must match the Base setting.

Set the **Elevation mask** to a reasonable value. **10** is the default.

If the observed **PDOP** is less than the **PDOP limit** the Rover will not FIX. **6** is a reasonable value.

Set the **RTK Frequency** to **1 Hz**, **2 Hz** or **5 Hz**. If you are using tilt compensation, **5 Hz** is best.

Set **Safe mode** to **Normal mode**.

Set the **Ionosphere model** to **No disturb**.

Set **Warn me when the Base moves** to **Yes**. If the base moves, or another user starts transmitting on the same frequency you will get a warning message.

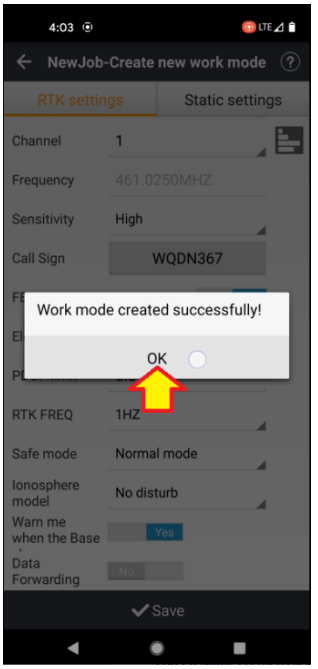
Set **Data Forwarding** to **No**.

Finally click on the **Save** button.

LandStar7 will ask for a profile name for the new Work mode:

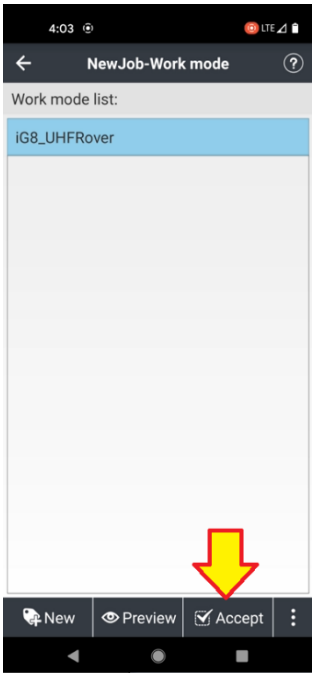
Enter a **Name** (**1**) then click **OK** (**2**).

A confirmation screen will be shown:



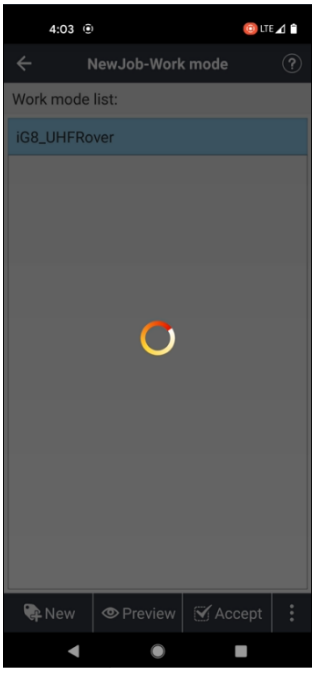
Click on **OK**.

On the **Work mode** list:



Highlight the new **Work mode** and then click on **Accept**.

Wait for the configuration to be uploaded to the Rover:



After a few seconds, if the upload was successful:

Click on **OK**.

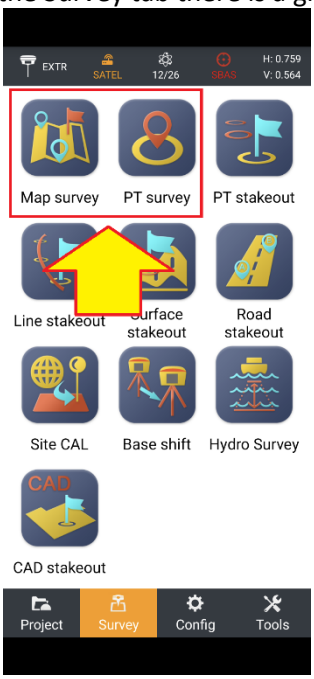
Back on the main menu:

The receiver status will be shown on the top line. If the receiver indicates FIX then you are ready to survey.

Survey: Store Points

Once your Rover receiver has been configured and has a FIXed solution, you are ready to survey.

On the Survey tab there is a graphical map-based **Map survey** and a text-based **PT Survey**:

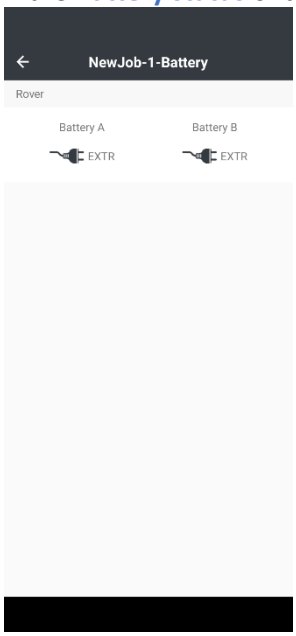


Click on **Map survey**.

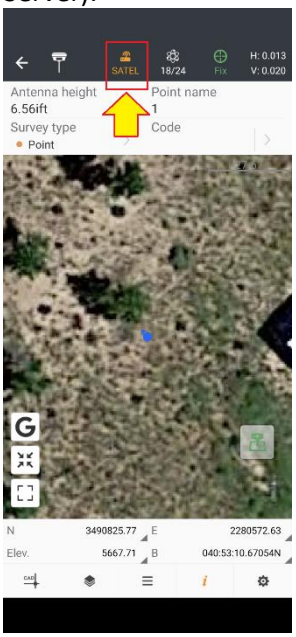
The Map survey screen will be shown.

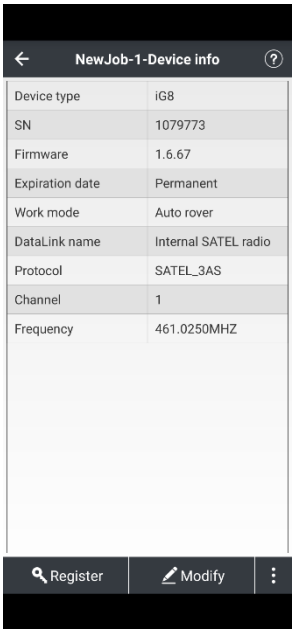
Let's work through the available buttons and information.

Click on the **Receiver** icon to view the **Battery status** of the receiver.

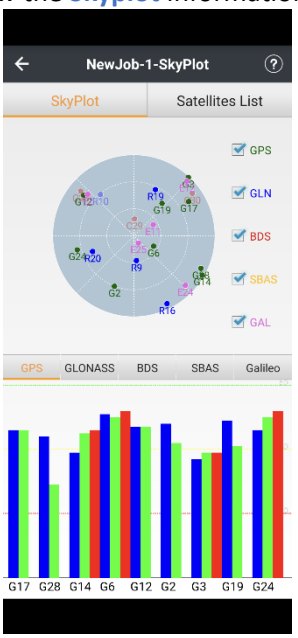


Click on the **Device Info** icon to view information about the **Data Link** (radio or Network Server):

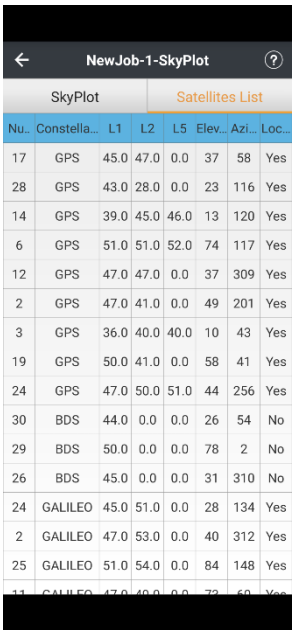




Click on the **Satellite** icon to view the **Skyplot** information for the receiver:



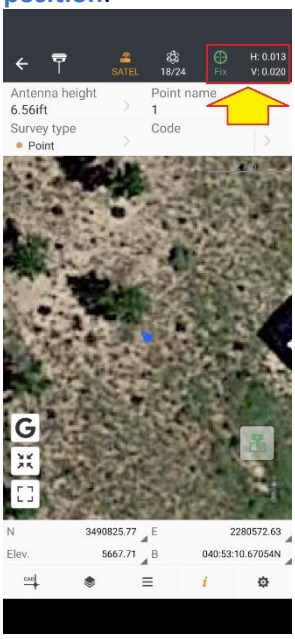
Satellite Plot

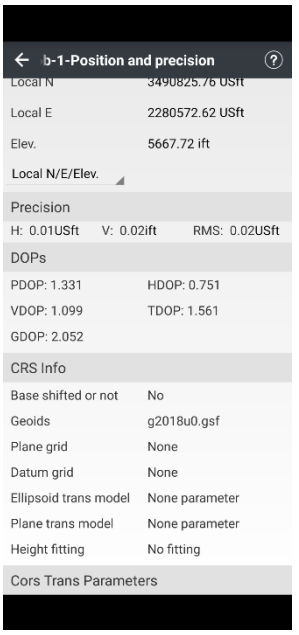


Nu..	Constella...	L1	L2	L5	Elev...	Azi...	Loc...
17	GPS	45.0	47.0	0.0	37	58	Yes
28	GPS	43.0	28.0	0.0	23	116	Yes
14	GPS	39.0	45.0	46.0	13	120	Yes
6	GPS	51.0	51.0	52.0	74	117	Yes
12	GPS	47.0	47.0	0.0	37	309	Yes
2	GPS	47.0	41.0	0.0	49	201	Yes
3	GPS	36.0	40.0	40.0	10	43	Yes
19	GPS	50.0	41.0	0.0	58	41	Yes
24	GPS	47.0	50.0	51.0	44	256	Yes
30	BDS	44.0	0.0	0.0	26	54	No
29	BDS	50.0	0.0	0.0	78	2	No
26	BDS	45.0	0.0	0.0	31	310	No
24	GALILEO	45.0	51.0	0.0	28	134	Yes
2	GALILEO	47.0	53.0	0.0	40	312	Yes
25	GALILEO	51.0	54.0	0.0	84	148	Yes

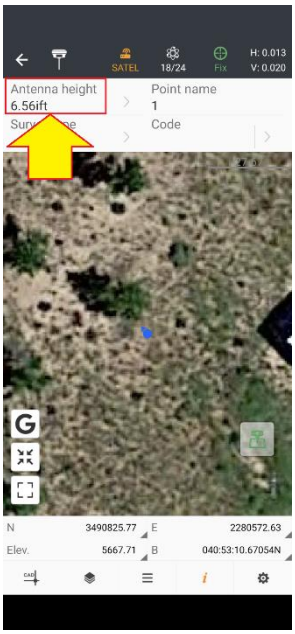
Satellite Information List

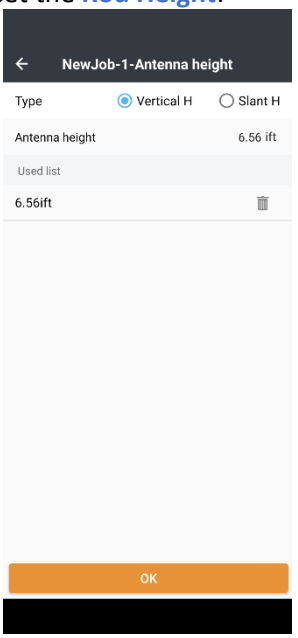
Click on the **Receiver solution** for detailed information on the solution **quality** and **position**:



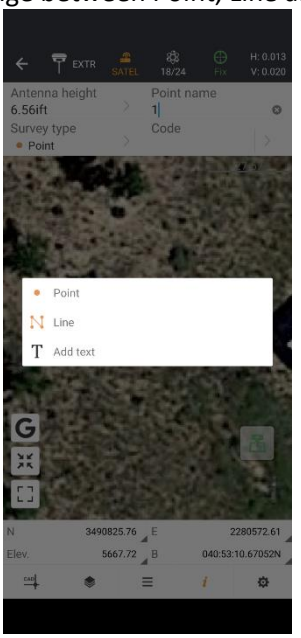


Click on the **Antenna height** to set the **Rod Height**:





Click on the **Survey type** to change between Point, Line and Text features:

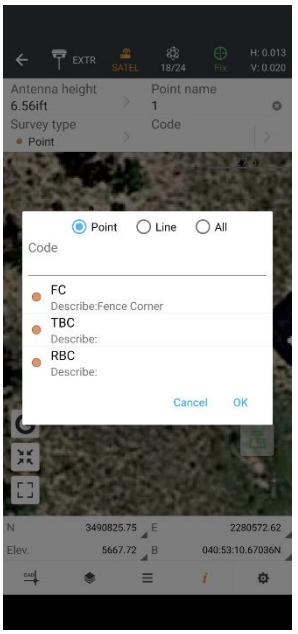


This allows you to draw linework in the field as points and line-inflection points are stored. Text places text, centered over the stored point for use as a visual note or building address.

Click on the **Point name** to directly enter a **Point name** or **number**:

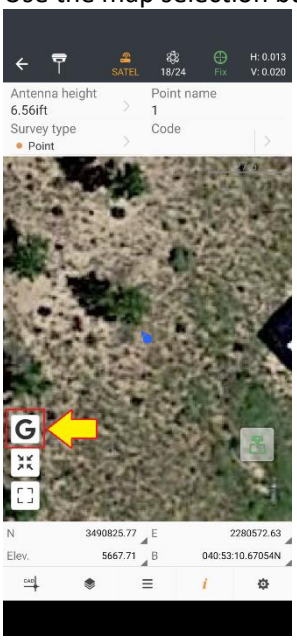
Point names must be unique across all points in the current job.

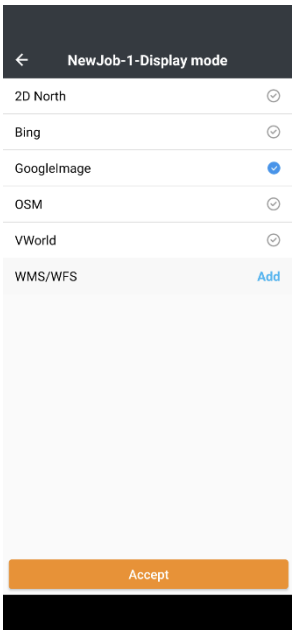
Click on the left side of the Code to directly enter a code with the keyboard, click on the right side to pick a code from the FC list:



On the Code entry box you can select by Point or Line feature types, you can type in the starting letters of the codes to narrow down the displayed list.

Use the map selection button to choose the background map:





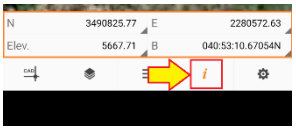
Map controls:

The  button centers the map at your current location.

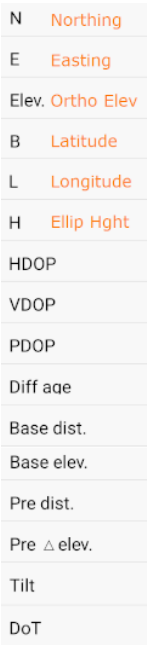
The  button zooms to the job extents.

The  store button can be dragged around the map face by clicking-and-holding then dragging.

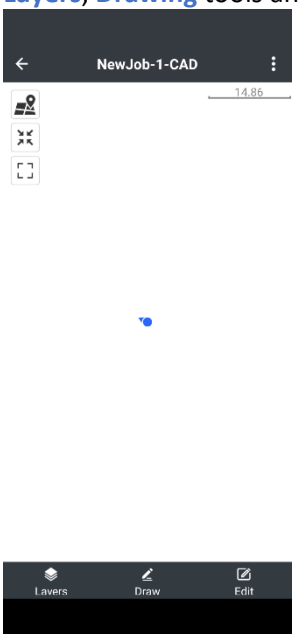
The *i* button on the screen bottom:

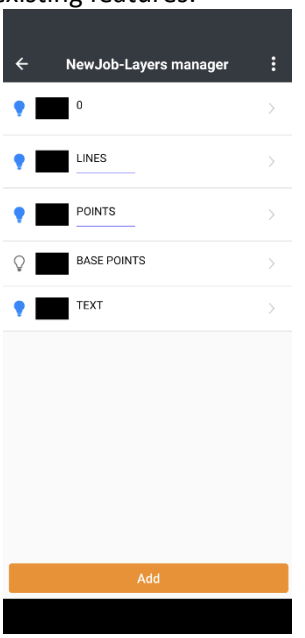


Toggles the visibility of the four information panels. You can customize the information panel values by clicking on them and selecting from this list:



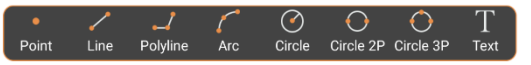
Clicking the CAD button display the **CAD tool** where you can modify the workspace with **Layers**, **Drawing** tools and **Edit** existing features:





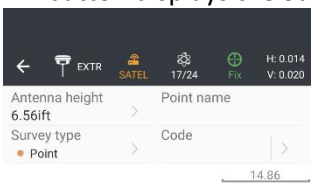
Layer Controls

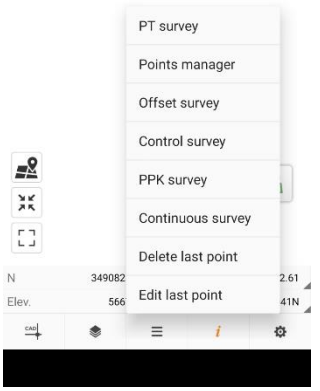
Draw controls:



Edit controls:

The ☰ button displays the Survey menu:





PT survey jumps to the text-based **Survey point** text menu.

Points manager displays the point list.

Offset survey allows storing a point offset from the receiver's current position.

Control survey takes a series of dumped receiver shots, see page

PPK survey allows you to collect static observations on a point in the internal memory of the receiver for post-processing.

Continuous survey will take a point at an interval: time or distance.

Delete last point removes the previously surveyed point.

Edit last point allows you to review, and add attributes to the previous point.

The **option** button  jumps to the **Settings survey** menus, see page 13 **Settings: GNSS**.

Control survey

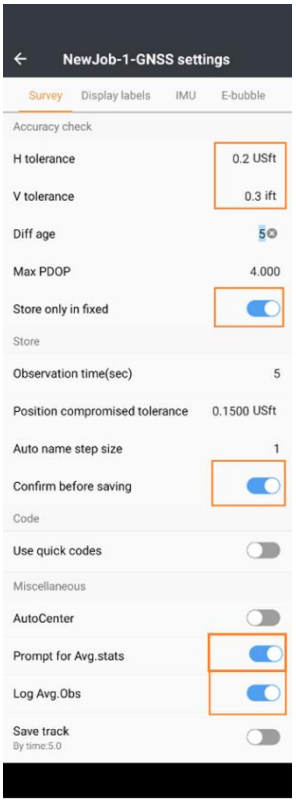
Often when working under heavy canopy or when acquiring positions that are extremely important you will want to make absolutely sure that you do not have a 'Bad FIX'.

LandStar7 has an automated **Control survey** style that fully dumps the receiver forcing a complete reacquisition of tracking, ambiguities and ephemeris between multiple observations. The process is fully automatic.

The Control PT sequence is:

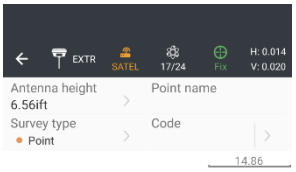
1. Take measurement epochs and form an average. *If the range of these measurements exceeds the 'Position compromised tolerance' is the average re-acquired or is it accepted?*
   Does the H Tolerance and V Tolerance on the Control PT screen override the values on Setup: Survey?
   Does the Qualification rate apply to the measurements in one average or the groups of averages?
2. Completely reset the OEM engine. This forces new tracking, ambiguity resolution and ephemeris. *Of course, it will take 30-minutes to re-acquire a full broadcast ephemeris, so I guess the Rover RTK engine is working without ephemeris?*
3. *What is the Measure Interval? I have*

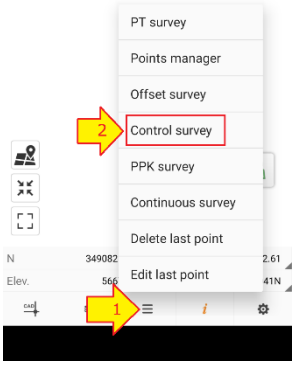
From the Map survey or PT survey modes, click on the **option** button  to jump to the **Settings survey** menu:



Set the **H** and **V tolerance** to values that will not prevent data collection in the current environment, turn on **Store only in fixed**, **Confirm before saving**, **Prompt for Avg. stats** and **Log Avg. Obs**. Then click on the back button to return to the Survey menu.

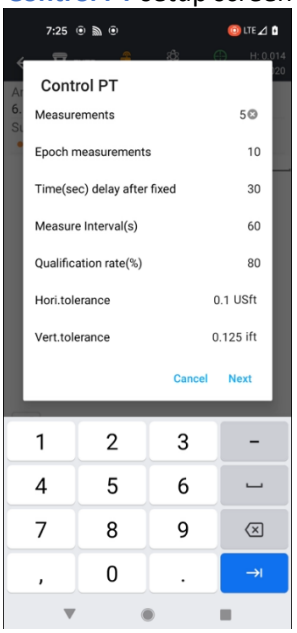
Next click on the ☰ button:





The click on the **Control survey** option.

The **Control PT** setup screen is shown:



Set **Measurements** to the number complete acquisition cycles you want to observe. Because the chance of getting 3 completely independent, matching, bad fixes in a row is astronomically low; **3** to **5** measurements is reasonable.

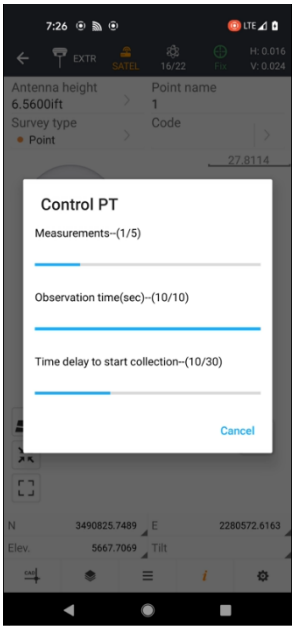
Epoch measurements is the number of observations to average for each receiver dump cycle.

Time (sec) delay after fixed is the delay after the receiver initializes and gets a fixed position to wait for the measurement to stabilize.

Measure interval(s) is time to wait for a valid measurement if the tolerances are not met.

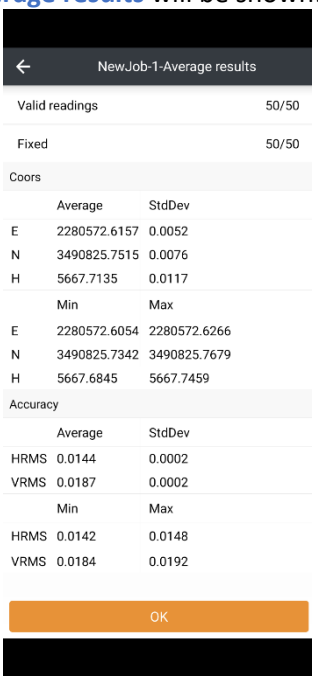
Qualification rate % is the minimum number of measurements that must match within the **Hori. tolerance** and **Vert. tolerance** to keep the measurement set.

When configuration is complete, click on **Next**.



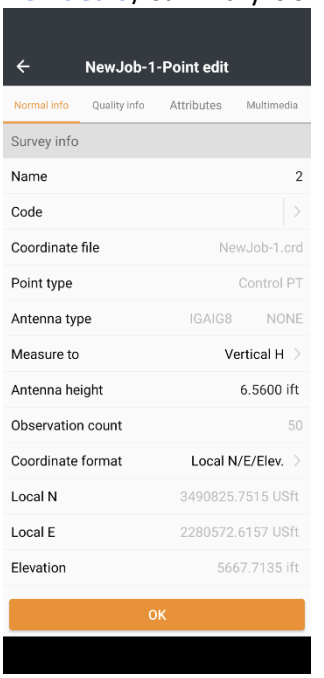
The **Control PT** operation will run to completion.

When the last epoch has been recorded, the **Average results** will be shown:



If acceptable, click on **OK** (click **back** to abort).

The **Point edit** / summary is shown:

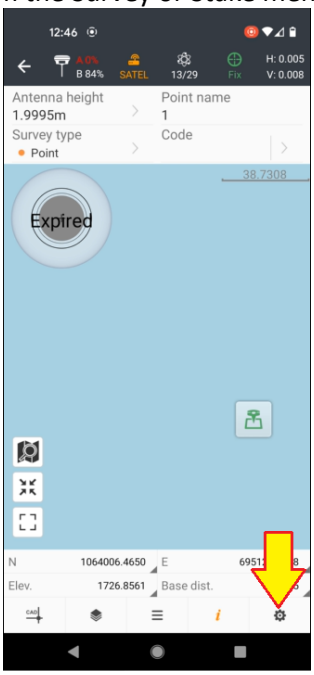


You can change the **Antenna height**, add **Attributes** or **Multimedia**.

When complete, click **OK**.

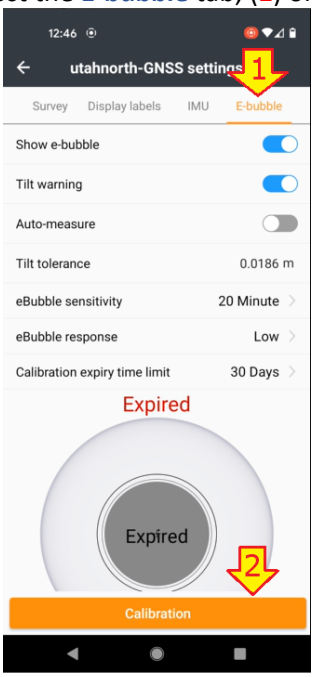
Using the Electronic-Bubble

From the Survey or Stake menu:



Click on the **Settings** gear.

Select the **E-bubble** tab; (**1**) on the top:



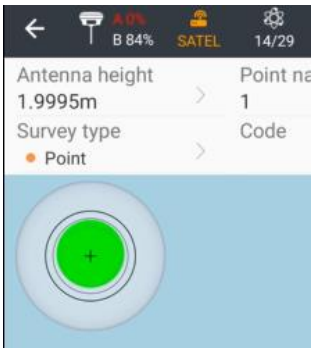
Enable **Show e-bubble** and the **Tilt warning**.

Level the pole and the receiver, then click (**2**) **Calibration**.

Additionally, you can make these settings:

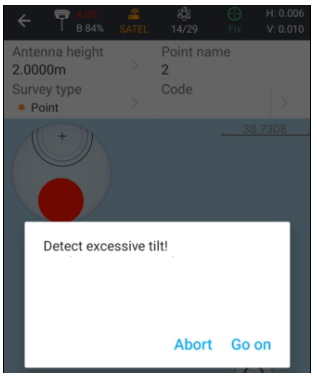
Show e-bubble

Shows the electronic bubble on the Store and Stake screens:



Tilt Warning and Tilt Tolerance

When **Tilt Warning** is enabled, the operator must override taking measurements:



when the measurement error introduced by pole tilt exceeds the **Tilt Tolerance**.

Auto measure

Measurements will automatically be stored when the rod and receiver are leveled within the Tilt tolerance.

This allows you to store repeated measurements without pressing the store button on the screen.

E-bubble Sensitivity

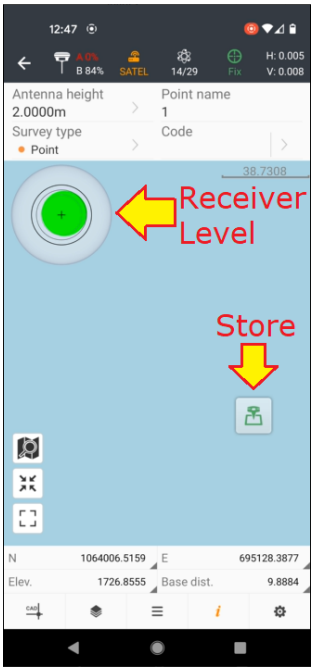
Select the sensitivity of the displayed bubble. Adjust the bubble display so that it has more or less resolution.

E-bubble Response

Set the update rate of the e-bubble.

Using the e-bubble

After enabling and calibrating the e-bubble, it will be shown as a floating bubble display on the store and stake screens:

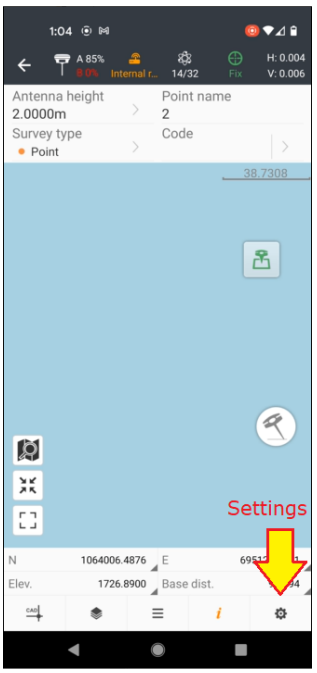


If the receiver display is rotated to face the operator, the bubble direction will align with the receiver's apparent orientation.

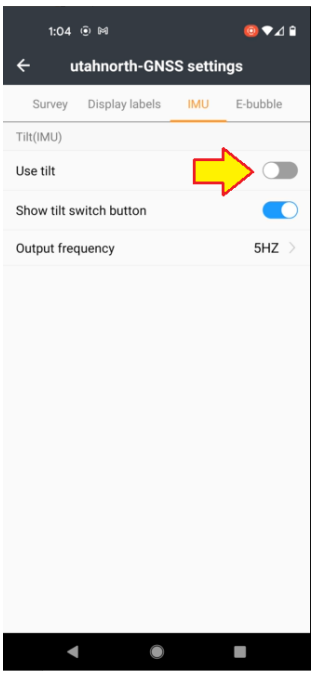
Using IMU Compensation

The iGage iG9 and CHC i90 receivers have built-in IMU heading + level indicators that allow the position of the rod point to be accurately computed.

You can activate the IMU in any of the Survey Store or Stake screens:



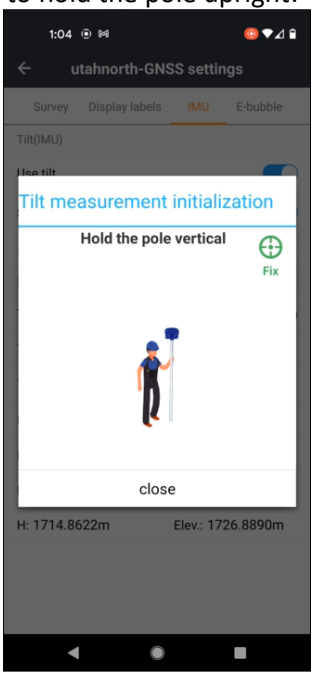
Click on Settings.



Set the **Use tilt** slider ON (Right).

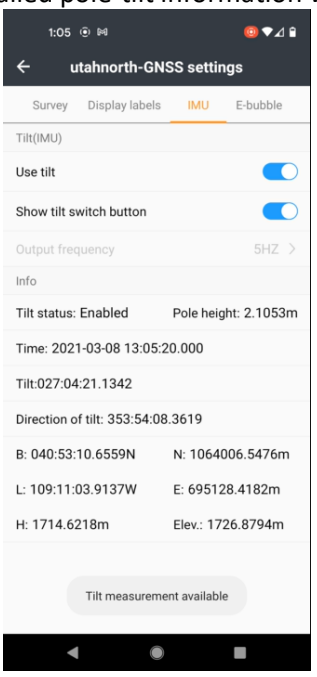
LandStar7 will immediately ask you to initialize the IMU.

And will ask you to alternate between asking you to hold the pole upright:



And rocking the pole forward then back to vertical (or left/right and back to upright again).

After a few moments the IMU initialize and detailed pole-tilt information will be shown:



Click the back arrow to return to the survey screen.

The IMU status is shown as a green tilt. Clicking on this moveable button allows toggling tilt compensation on and off.